JOURNAL OF CHEMISTRY AND CHEMICAL SCIENCES
An International Open Free Access, Peer Reviewed Research Journal
www.chemistry-journal.org

ISSN 2229-760X (Print)
ISSN 2319-7625 (Online)
Abbr: J. Chem. & Cheml. Sci.
2014, Vol.4 (3): Pg.118-124

Assessment of Ground Water Quality of Noamundi, Jharkhand with Special Reference to Iron

Arbind Pd Pandit, Vishnu S. Sinha[1], Nandjee Kumar[2] and Udaykant Choudhary[3]

P.G. Department of Chemistry,
Tata College Chaibasa, INDIA.
[1]P.G. Department of Botany,
Tata College Chaibasa, INDIA.
[2]Department of Botany,
Magadh University, Bodh Gaya, INDIA.
[3]PGT, Tata DAV Public School,
Noamundi, INDIA.

(Received on: May 30, 2014)

ABSTRACT

Noamundi is situated in the West Singhbhum District of Jharkhand State. It is a small mining town located close to the Odisha boarder. It lies near to Chaibasa, West Singhbhum, Jharkhand. The major product of this mine is iron ore (including blue dust).The majority of mines are run by Tata Steel. There are also a lot of private mine-owners have also set up shop in and around the town. Noamundi is located in the heart of Saranda forest, which is the densest deciduous forest of Asia. Saranda, in the local tribal language means The land of 700 hills. The present study deals with physico-chemical parameters of Ground Water of five different areas of Noamundi that is Noamundi college(S1), DVC Kalimandir(S2), Noamundi busstop(S3), Lakhansai (S4) and Normandy Bazar (S5). The ground Water Parameters such as P^H, Alkalinity, Total hardness,Calcium hardness, Iron, Nitrate, Nitrite, Ammonium, Fluorides Chloride, Residual chlorine,Arsenic etc. were estimated in the samples to evaluate their quality. Our results reveals that concentration of DO, BOD, Sulphate, Phosphate etc. are negligible in comparison to permissible limits. Whereas concentration of iron in the selected samples were found from 1

mg/l (S2 and S4) to 5 mg/l (S1andS3). Mostly Samples have a high value of Iron exceeding the permissible limit that is 0.3 to 1mg/l. The high value of Iron is due to heavy Iron ore mining activities takes place at Noamundi. The high value of Iron needs proper treatment of ground water before use.

Keywords: Iron, Ground Water, Physico-Chemical Parameters, Saranda.

INTRODUCTION

Groundwater constitutes about 95% of the fresh water on our planet performed fundamental need of human beings and economic growth. Ground water is an integral part of hydrological cycle. The availability of ground water depends upon its recharge technique mainly by rainfall .As per United Nations Environment Programme (UNEP) about two billion people depend directly upon aquifers for drinking water.About 40% of worlds food are produced by ground water irrigation.Due to rapid growth in agriculture development ,industrialization and urbanization there is overexploitation and contamination of ground water resources in parts of the country, resulting in various adverse environmental impacts and threatening its long term sustainability. In this situation ,The National Water Policy, 2002 had given guide lines that exploitation of ground water resources shoud be so regulated as not to exceed the recharging possibilities,as also to ensure social equity.

Ground water contamination are mainly due to seepage pits,refuse dumps, septic tanks, barnyard manures, transport accident and different pollutants. Raw sewage which are mainly dumped in shallow soakpits is responsible for cholera, hepatitis, dysentery etc. health problems especially in areas with high water table. The industries of woolens, bicycles in areas of Punjab (Ludhiana) and Haryana (Ambala, Sonepat) contribute high amounts of Ni,Fe,Cu,Cr and cyanides to ground water. (Ecology and Environment-P.D.Sharma 10^{th} edition).

According to Ground Water Estimation Committee(GEC)-97 the total annual replenishable ground water resources of the country have been estimated as 432 billion cubic meter(bcm) in which 34 bcm naturally discharge and only 398 bcm ground water are available annually for the entire country .The annual ground water draft is 231 bcm out of which 213 bcm(92%) is for irrigation use and 18 bcm (8%) is for domestic and industrial use. (92%).(Bimal Prasanna Mohanty *et al*. 2011).

MATERIAL AND METHODS

STUDY AREA

Noamundi is located at $22^0.15^0$ N Latitude and 85.53^0E Longitude. It has an average elevation of 487 metres (1597 feet). The temperature varies from 9^0 c(in winter) to 42^0C (in summer). The average relative humidity is about 58% and the average rainfall is about 1200mm.

In the present investigation, there are five water samples from different areas of Noamundi were collected in the month of

June 2012 to estimate quality of Ground water. These water were extensively used for drinking purposes. These sampling stations are,Noamundi college (S1),DVC Kalimandir (S2), Noamundi bus stop (S3) Lakhansai(S4) and Noamundi Bazar (S5).

The analysis of Phosphate, Iron, P^H, Total Alkalinity, Calcium Hardness, Nitrate, Nitrite, Ammonium, Fluoride, Residual-chlorine, chloride, Arsenic, Total hardness etc. were carried out by water testing kits which are supplied by Nice Chemicals (P)Ltd. Cochin, Kerala. The temperature of water samples were measured by thermometer (Celsius). The estimation of iron was carried out immediately on the sampling station. The water analysis observed data were compared with the standard data provided by WHO for drinking purposes.

Table 1 : Showing different Physico-Chemical Parameters of Ground Water of Noamundi.

Sl. No.	Parameters	STUDY AREA LOCATION				
		S1	S2	S3	S4	S5
1.	Temperature(ºC)	37	37	37	38	38
2.	P^H	9	9	8	8	8
3.	Alkalinity (mg/l)	90	80	60	150	100
4.	Phosphate (mg/l)	0.5	0.0	0.0	0.0	0.0
5.	Iron (mg/l)	5	1	5	1	3
6.	CalciumHardness (mg/l)	100	75	50	35	75
7.	Nitrate (mg/l)	5	20	20	50	30
8.	Nitrite (mg/l)	0.5	1.0	3.0	0.5	0.5
9.	Ammonium (mg/l)	0.5	0.0	0.5	0.0	0.5
10.	Fluoride (mg/l)	0.0	0.0	0.0	0.0	0.0
11.	Residual chlorine (mg/l)	0.0	0.0	0.0	0.0	0.0
12.	Chloride (mg/l)	20	30	30	120	80
13.	Arsenic (mg/l)	0.0	0.0	0.0	0.0	0.0
14	Total hardness (mg/l)	125	150	250	100	150
15	Sulphate (mg/l)	160	130	140	130	150
16	Sodium (mg/l)	30	40	50	35	40
17	Potassium(mg/l)	12	10	11	9	9
18	DO (mg/l)	2.4	2.8	2.6	3.0	3.5
19	BOD(mg/l)	2.6	2.4	3.0	3.5	2.6

RESULTS & DISCUSSION

The physico-chemical characteristics of Ground Water are given in Table-1 and data are comparing with WHO (1992) and IS : 10500 standards for drinking water.

1. **TEMPERATURE:** The temperature of different sampling Stations ranges from 37ºC (S1,S2, and S3) to 38^0C(S4 and S5).The temperature of ground water depend upon the solar radiation and atmospheric temperature (Garg *et al*., 2009; Narayana

et al. 2008, Verma *et al.* 2011). The Temperature of ground water also effect the phosphate, hardness and DO but it shows negative result with ammonia.

2. P^H :The P^H value of Ground water varies from 8(S3, S4 and S5) to 9(S1 and S2). The desirable P^H range for drinking water is 6.5 to 8.5 (WHO). The Slightly increase in P^H is due to presence of salt of weak acid or strong bases.The alkaline nature of water is also related to the bicarbonate formed due to reaction takes place between carbondioxide and minerals(Sinha and Biswas, 2011;Saxena and Saksena, 2012).

3. ALKALINITY: The Alkanity values are varies from 60 mg/l(S3) to 150 mg/l(S4).The values of alkanity are within the permissible limit as per WHO (200mg/l) and BIS (120mg/l) with respect to the drinking water.

4. **IRON**: The values of iron generally observed higher than permissible limit for drinking water asn per WHO guidelines. (1mg/l). The value of iron were observed 1mg/l for S2 and S4 whereas 3 gm/l for S5 and 5 gm/l for S1 and S3 sampling stations. Iron is an essentional metal for metabolism in living organism. The presence of iron in ground water is generally observed as soluble ferrous or insoluble ferric iron state. The continuous drinking of higher concentrated iron leads to a disease known as Haemosiderosis (Strom,1944). Noamundi is an iron ore dominated area hence minig activities in these areas are major cause of higher concentration of iron in ground water. The concentration of iron in ground water is controlled by both physiological and microbiological factors. High concentration of iron has been observed in ground water in the country about more than 1.1 lakh habitations. (Bimal Prasanna Mohanty *et al*. 2011). The districts of Jharkhand effected with high concentration of iron (greater than 1mg/l) are Chatra, Deoghar, East Singhbhum, West Singhbhum, Giridih and Ranchi (Central ground water authority).The state which are effected with high concentration of iron are Assam, West Bengal, Orissa, Chhattisgarh and Karnataka. The localized pockets are observed in states of Norh East, Bihar, UP, Punjab, Rajasthan, Maharashtra, Madhya Pradesh, Jharkhand, Tamil Nadu and Kerala. The use of highly contaminated ground water can cause health disorder such as skin, digestive, respiratory, nervous system, kidney, spinal cord, heart, mental imbalance, miscarriage and cancer.

5. TOTAL HARDNESS: The values of total hardness varies from 100 mg/l (S4) to 250 mg/l (S3) which are within the permissible limits i.e. 250 mg/l as per BIS guide lines for drinking water.

6. CALCIUM HARDNESS: The calcium hardness in ground water samples were varies from 35 mg/l (S4) to 100 mg/l (S1).The permissible limit for calcium hardness in drinking water is 200 mg/l IS: 10500-1993. The observed values of calcium hardness in sampling stations are within the permissible limit.

7. NITRATE: The values of nitrates were varied from 5 mg/l at S1, 20 mg/l at S2 and S3 ,30mg/l at S5 and 50 mg/l at S4 sampling stations. These valves are within the permissible limit *i.e.*,100 mg/l (WHO).

8. NITRITES: The value of nitrites were varied from 0.5mg/l at sampling station

S1,S4,S5 and 1.0 mg/l at S2 and 3 mg/l at S3 sampling stations. These observed values are within the permissible limits.

9. CHLORIDES: The chloride value ranged from 20 (S1) to 120 mg/l (S4) which are within the permissible limits. The Permissible limit for chloride is 250 mg/l as suggested by WHO and ISI.

10. Ammonium, Phosphate, Residual Chlorine, Fluoride, Arsenic, DO, BOD etc. were observed negligible concentration in the ground water samples of Noamundi.

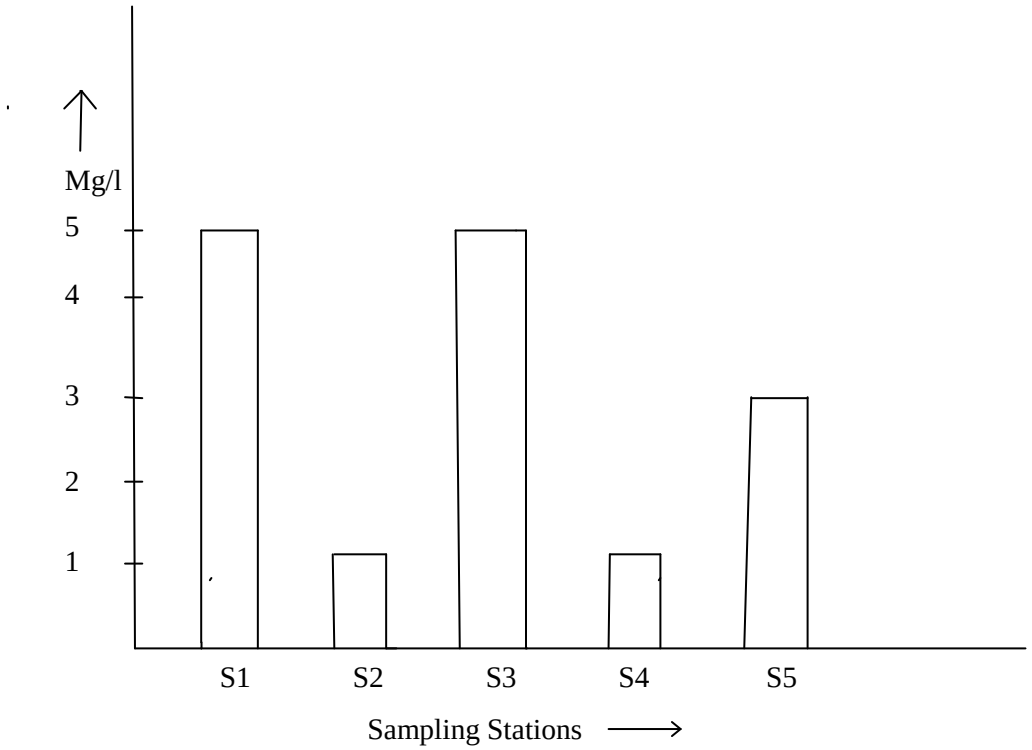

Fig 1 : Iron concentration of different sampling stations

CONCLUSION:

It was observed that the value of , P^H, Calcium Hardness, Nitrate, Nitrite, Ammonium, Fluoride, residual Chlorine, Chloride, Total hardness and Arsenic are within the permissible limits where the value of Iron is more than the permissible limits. The high concentration of Iron needs proper treatment before, the use for drinking and Irrigation purposes to avoid harmful effects.

REFERENCES

1. APHA. Standard methods for the Examination of water and wastewater, 17thEdition.American Public Health Association, Washington DC (1989).

2. Bimal Prasanna Mohanty, Sudeshna Banerjee, Sasmita Mohanty and Anil Prakash Sharma: Depletion and contamination of national groundwater reserve-A challenge to safe drinking water supply, *National Academy Science letters*, Vol.34 No 11 & 12, 383-391 (2011).
3. BIS. Indian Standard specification for Drinking Water, IS:10500, Bureau of Indian Standards, New Delhi (1998).
4. Biswal. S. K., Majhi, B and Behera. J. P. Ground water quality near ashpond of thermal power plant. *Poll. Res* 20:457-490 (2001).
5. Department of Environment. Methods for the examination of waters and associated materials :chlorides in waters, sewage and effluents 1981. London, Her Majesty's stationery office, (1981).
6. Dyaneshwari P and Meena D. Seasonal variation ion DO and BOD of some lentic water bodies of Kolhapur city (MS) *Geobios* 33:70-72 (2006).
7. Doctor P B ,Paiyani C V, Desai N M, Kulkarni P K, Ruparelia and Ghosh SK. Physcio-chemical and microbial analysis of Dye contaminated river water. *Ind. J. Environ. Hlth*. 40 : 7-14 (1998).
8. Ecology and Environment- P.D.Sharma 10th revised edition2008-2009 Rastogi Publications Meerut-Delhi.
9. European Water Commission 2007. Environment Agency. Preparing for climate change impact on fresh-water ecosystem (PRINCE). Science Report: SC030300/SR. Environment Agency. Bristol (2007).
10. Gautam R.H and Kumar Rohilashar. A *Journal on Rural Developing Kurukshetra* , Vol. 58 NO 7 (2010).
11. ICMR. Manual of Standards of Quality of Drinking Water Supplies. Indian Council of Medical Research, New Delhi. Special Reports No. (44)27 (1975).
12. International Organization for Standardi-zation water quality –determination of chloride, Geneva. (ISO 2297;1989).
13. ISI, Drinking water specification, Indian standard Institute, New Delhi (1991).
14. Jain, C.K. Bhatia. K. K. S. Kumar. C. P. and. Purandara. B.K. Ground water quality in Malaprabha sub-basin, Karnataka. *Ind. J. Prot.* 23:321-329 (2003).
15. Kudesia, V.P. Water Pollution, Third revised edition, Pragati Prakashan, Meeret. Lalitha S 2003 Impact of sewage disposal on quality of water near Chinthamani, Tiruchirapalli. *Indian J. Env. Prot.* 23:1268-1271 (1990).
16. Neeraj Verma, Studies on the drinking water and irrigation water resources of Industries state, Ph.D Thesis, Barkatullah University, Bhopal, India (1994).
17. Patil P R; Patil S K and Dhandae A D. Studies on drinking water quality in Bhuswal corporation water supply (2002).
18. Ravichandran, C; Alagappa Moses, A; Girija, K. and Chakravarthy, P. Drinking water quality assessment in few selected pilgrim centres and tourist spots in Tamilnadu, *India. J. Env. Prot.* 22:129-136 (2002).
19. Pollutants in Groundwater: Risk Assessment, (AG-439-8), by M. G. Cook and J. P. Zublena (1993).
20. Saxena, M. and Saksena, D.N. Water quality and trophic status of Raipur

reservoir in Gwalior, Madhya Pradesh. *J. Nat. Sci. Res* 2;82-96 (2012).
21. Sinha, S.N. and Biswas, M. Analysis of physico-chemical characteristics to study the water quality of a lake in Kalyani, West Bengal. *Asian J. Exp. Biol. Sci*. 2:18-22 (2011).
22. Sharma B K and Kaur H Environmental Chemistry Third edition. Krishana Prakashan Media (P) Ltd, Meeret. Page no. Env 30-32,Water 67-76 (1996-97).
23. Sud, Surender. Beware: Water is Fast Becoming Scarce Yojana41 (8) : 47- 48 (1997).
24. Sallae, A.J. Water borne diseases in Fundamental Principals of Bacteriology, 7th Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi (1975).
25. Senthilkumar RD; Narayansamy, R and Ramkrishan K. Pollution studies on sugar mill effluent physic-chemicals characteristics and toxic metals *Poll. Res*. 20:93-97 (2001).
26. Storm, K. M. High mountain limnology-some observation on stagnant and running waters of the Rondane area Avh. Norske, Vidensk Akad. *Mat-nat*. H; 24 1944).
27. WHO, International Standards for Drinking Water, World Health Organisation, Geneva, Switzerland (1992 & 1999).
28. WHO, Guidelines for drinking water quality,2nd Ed.Vol.2.Health criterira and other supporting information. (1996).
29. www.qualityofgroundwater.com.